

# Anti-oxidant activity of acetyl-L-carnitine (ALC) and effect of green leaf odor on stress

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In a previous study, it has been reported that ALC is reduced in some brain regions of the patients with chronic fatigue syndrome. To investigate the significance of ALC in brain functions, we examined effects of ALC ( ) on the hydroxyl radical generation, ( ) on the viability of cultured PC-12 cells exposed to oxidant stress, ( ) on the brain lipid hydroperoxide level of senescence-accelerated prone-8 mice (SAMP8), and ( ) on the retention latency in passive avoidance test of SAMP8 with the deteriorated learning ability. In addition, we carried out to investigate ( ) an effect of green leaf odor on brain amine metabolisms of rats exposed to immobilization stress. Results obtained in the present study were as follows.

(i) The effect of ALC on the hydroxyl radical generation by the metal-dependent Fenton reaction was examined by the ESR spin trapping technique using 5,5-dimethyl-1-pyrroline-N-oxide (DMPO) as the spin trap reagent. ALC significantly inhibited the formation of the DMPO-OH adduct produced by the reaction with the hydroxyl radical (1).

( ) The effect of ALC on the viability of cultured PC-12 cells exposed to hydroxyl radicals produced by a photo-Fenton reaction agent (NP- ) and UV was investigated. Application of 50  $\mu$ M ALC to the cultured medium significantly increased the viability of PC-12 cells.

( ) Brain lipid hydroperoxide levels were significantly higher for SAMP8 than for controls in 2 to 9 months of age (2,3). When the lipid hydroperoxide levels were examined in SAMP8 with repeated (every two days) intraperitoneal injections of ALC from 3 weeks of age to 4 months of age, the levels of SAMP8 treated with 400 mg/kg ALC were significantly low compared to those of saline controls (4).

( ) When the retention latency in passive avoidance test was examined in SAMP8 treated with 400 mg/kg ALC as described in ( ), the latency was significantly shorter for SAMP8 than for controls (4).

( ) Brain serotonin metabolism in rats was increased by immobilization stress. Inhalation of green leaf odor during immobilization stress significantly restored the increased serotonin metabolism.

These results suggest that ALC has the anti-oxidant activity through the scavenging effect of hydroxyl radicals, and that the anti-oxidant activity of ALC ameliorates the deteriorated learning ability of SAMP8. In addition, present result may indicate that green leaf odor has the healing effect on stress through the normalization of brain amine metabolism.

#### References

1. Yasui F., Imai Y., Matsugo S., Sasaki K. and Konishi T.: Antioxidant and/or prooxidant activities of carnitine and its derivative on the hydroxyl radical generation by the Fenton reaction. *ITE Letters on Batteries, New Technologies & Medicine*, 3:58-62 2002.
2. Matsugo S., Kitagawa T., Minami S., Esashi Y., Oomura Y., Tokumaru S., Kojo S., Matsushima K. and Sasaki K.: Age-dependent changes in lipid peroxide levels in peripheral organs, but not in brain, in senescence-accelerated mice. *Neurosci. Lett.*, 278:105-108, 2000.
3. Yasui F., Ishibashi M. Matsugo S., and Sasaki K.: Brain lipid hydroperoxide level increases in senescence-accelerated mice at earlier stage of their life span. in preparation.
4. Yasui F., Matsugo S., Ishibashi M., Kajita T., Ezashi Y., Oomura Y., Kojo S. and Sasaki K.: Effect of chronic acetyl-L-carnitine treatment on brain lipid hydroperoxide level and passive avoidance learning in senescence-accelerated mice. *Neurosci. Lett.*, 334: 177-180, 2002.